

Claims

What is claimed is:

1 1. A computer-implemented automated building design and modeling and
2 project cost estimation and scheduling ("DMES") system comprising:

3 a spatial database;

4 means for creating instances of parametric objects in said spatial database,

5 wherein each of said parametric objects represent a construction component of a
6 structure being modeled and includes a user interface for enabling a user to input
7 design data thereto; and

8 means for initiating automatic assembly of said parametric objects to create a
9 building model.

10 2. The system of claim 1 further comprising means for creating a graphical
11 representation of said building model.

12 3. The system of claim 2 wherein said graphical representation is selected
13 from the group consisting of design development drawings, specifications,
14 construction drawings, shop drawings, and details.

1 4. The system of claim 1 further comprising means for creating a cost
2 estimate for said structure from said building model.

1 5. The system of claim 1 further comprising means for creating a
2 construction schedule for said structure from said building model.

1 6. The system of claim 1 wherein said objects comprise ordinary elements
2 and massing elements, said massing elements being capable of placing instances of
3 other objects into the spatial database and subsequently passing data thereto and
4 receiving data therefrom.

1 7. The system of claim 6 wherein said ordinary elements and massing
2 elements are assembled into said building model according to a sequential assembly
3 hierarchy.

1 8. The system of claim 6 wherein said means for initiating automatic
2 assembly comprises a massing element.

1 9. The system of claim 6 wherein said user interface comprises a dialog
2 box.

10 10. The system of claim 6 wherein each of said massing elements comprises:
11 means for detecting a physical clash between an existing instance of an object
12 and an instance of an object currently being placed by said massing element; and
13 means for avoiding the detected physical clash by automatically relocating said
14 instance of an object currently being placed according to predefined placement rules.

15 11. The system of claim 1 further comprising:
16 means for initially assembling said building model using an initial value for at
17 least one selected parameter of said structure;
18 means for saving results of said initial assembling;
19 means for incrementing said initial value by a selected amount;
20 means for reassembling said building model using said incremented initial
21 value for said at least one selected parameter;
22 means for saving results of said reassembling;
23 means for repeating said incrementing, reassembling and saving results of said
24 reassembling until a value for said at least one selected parameter is equal to a
25 selected final value; and
26 means for providing said saved results to a user.

1 12. The system of claim 1 wherein said saved results are provided to said
2 user in the form of a graph.

1 13. The system of claim 1 wherein one of said objects is a grouping massing
2 element, said grouping massing element specifying parametric behavior required of
3 objects that it assembles in said building model, which objects may be either
4 parametric or non-parametric.

1 14. The system of claim 1 wherein each of said objects includes an internal
2 interface for enabling said object to interact with other ones of said objects.

1 15. A computer program product, comprising:
2 a computer program processable by a computer system for causing the
3 computer system to:
4 create instances of parametric objects in a spatial database, wherein
5 each of said parametric objects represents a construction component of a structure to
6 be modeled and includes a user interface for enabling a user to input design data to
7 said parametric object;
8 initiate automatic assembly of said parametric objects to create a
9 building model; and
10 apparatus from which the computer program is accessible by the computer
11 system.

1 16. The computer program product of claim 15 wherein said computer
2 program further causes the computer system to create a graphical representation of
3 said building model.

1 17. The computer program product of claim 16 wherein said graphical
2 representation is selected from the group consisting of design development drawings,
3 specifications, construction drawings, shop drawings, and details.

1 18. The computer program products of claim 15 wherein said computer
2 program further causes the computer system to create a cost estimate for said
3 structure from said building model.

1 19. The computer program product of claim 15 wherein said computer
2 program further causes the computer system to create a construction schedule for
3 said structure from said building model.

1 20. The computer program product of claim 15 wherein said objects
2 comprise ordinary elements and massing elements, said massing elements being
3 capable of placing instances of other objects into the spatial database and
4 subsequently passing data thereto and receiving data therefrom.

1 21. The computer program product of claim 20 wherein said ordinary
2 elements and massing elements are assembled into said building model according to a
3 sequential assembly hierarchy.

1 22. The computer program product of claim 15 wherein said user interface
2 comprises a dialog box.

1 23. The computer program product of claim 22 wherein each of said
2 massing elements comprises:

3 computer program code for detecting a physical clash between an existing
4 instance of an object and an instance of an object currently being placed by said
5 massing element; and

6 computer program code for avoiding the detected physical clash by
7 automatically relocating said instance of an object currently being placed according to
8 predefined placement rules.

1 24. The computer program product of claim 15 wherein said computer
2 program further causes the computer system to:

3 initially assemble said building model using an initial value for at least one
4 selected parameter of said structure;
5 save results of said initial assembling;
6 increment said initial value by a selected amount;
7 reassemble said building model using said incremented initial value for said at
8 least one selected parameter;
9 save results of said reassembling;
10 repeat said incrementing, reassembling and saving results of said reassembling
11 until a value for said at least one selected parameter is equal to a selected final value;
12 and
13 provide said saved results to a user.

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15 25. The computer program product of claim 24 wherein said saved results
16 are provided to said user in the form of a graph.

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18 26. The computer program product of claim 15 wherein one of said objects
19 is a grouping massing element, said grouping massing element specifying parametric
20 behavior required of objects that it assembles in said building model, which objects
21 may be either parametric or non-parametric.

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23 27. The computer program product of claim 15 wherein each of said objects
24 includes an internal interface for enabling said object to interact with other ones of
25 said objects.

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27 28. A method of implementing a computer-implemented automated building
28 design and modeling and project cost estimation and scheduling ("DMES") system,
29 the method comprising:

30 creating instances of parametric objects in said spatial database, wherein each

5 of said parametric objects represents a construction component of a structure being
6 modeled and includes a user interface for enabling a user to input design data
7 thereto; and
8 inputting design data for use by said instantiated parametric objects; and
9 automatically assembling said parametric objects to create a building model for
10 said structure.

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29. The method of claim 28 further comprising generating a graphical representation of said building model.

15 30. The method of claim 29 wherein said graphical representation is
20 selected from the group consisting of design development drawings, specifications,
35 construction drawings, shop drawings, and details.

15 31. The method of claim 28 further comprising creating a cost estimate for
20 said structure from said building model.

15 32. The method of claim 28 further comprising creating a construction
20 schedule for said structure from said building model.

1 33. The method of claim 28 wherein said objects comprise ordinary
2 elements and massing elements, the method further comprising said massing
3 elements placing instances of other objects into the spatial database and subsequently
4 passing data thereto and receiving data therefrom.

5 34. The method of claim 33 wherein said ordinary elements and massing
6 elements are assembled into said building model according to a sequential assembly
7 hierarchy.

1 *Part
A3* 35. The method of claim 28 wherein said user interface comprises a dialog

2 box.
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36. The method of claim 33 further comprising, for each object that is instantiated in the spatial database:

3 detecting a physical clash between an existing instance of an object and an 4 instance of an object currently being placed by said massing element; and

5 avoiding the detected physical clash by automatically relocating said instance 6 of an object currently being placed according to predefined placement rules.

1 37. The method of claim 28 further comprising:

2 initially assembling said building model using an initial value for at least one 3 selected parameter of said structure;

4 saving results of said initial assembling;

5 incrementing said initial value by a selected amount;

6 reassembling said building model using said incremented initial value for said 7 at least one selected parameter;

8 saving results of said reassembling;

9 repeating said incrementing, reassembling and saving results of said 10 reassembling until a value for said at least one selected parameter is equal to a 11 selected final value; and

12 providing said saved results to a user.

1 38. The method of claim 37 wherein said saved results are provided to said 2 user in the form of a graph.

1 39. The method of claim 28 further comprising a grouping massing element 2 specifying parametric behavior required of objects that it assembles in said building 3 model, which objects may be either parametric or non-parametric.

1 40. The method of claim 28 further comprising providing each of said

2 objects with an internal interface for enabling said object to interact with other ones
3 of said objects.

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